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THE I.C.I. MAGAZINE
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The *I.C.I. Magazine* is published for the interest of all who work in I.C.I., and its contents are contributed largely by people in I.C.I. It is edited by Sir Richard Keane, Bt., and printed at The Kynoch Press, Birmingham, and is published every month by Imperial Chemical Industries Limited, Imperial Chemical House, Millbank, London, S.W.1. Phone: VICtoria 4444. The editor is glad to consider articles for publication, and payment will be made for those accepted.

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FRONT COVER: *"Lazy Days," by T. Keeley*

OUR CONTRIBUTORS

P. G. Harvey *of Billingham Division is now Senior Plant Manager at Dowlais Works. Before that he was a Plant Manager at Olefine Works, Wilton. He is a chemistry graduate from Birmingham University and joined the Company in* 1947.

Cedric Jagger *of Central Publicity Department has written several articles for the* Magazine *in the last few years ranging from descriptions of chemical plant to his own private hobby of collecting antique watches and clocks. And as a contrast to his antiques he will shortly be receiving a modern watch—on completion of* 20 *years' service.*

Roy Shirley, *of Secretary's Department at Head Office, served in the R.A.F. from* 1941 *to* 1946 *in an aircrew capacity (Air Gunner). Shot down December* 1944 *while attacking Köln-Nippes railway junction near Cologne, Germany. Escaped from P.O.W. column near Nuremberg and reached England two weeks before V.E. day.*

The Human Element

By a special correspondent

One question above all others must be answered before I.C.I. puts a new compound into production: can it be produced without risking the health of plant workers? The responsibility of finding the answer falls on a team of industrial hygiene experts, backed up by Division medical officers.

THE chemical industry offers more potential hazards to life and health than many other industries, and yet it has proved to be one of the safest. How does this come about?

There are many laws to protect workers in industry from known risks—lead poisoning, mercury poisoning, pneumoconiosis and dermatitis are just a few of the industrial diseases which these laws recognise. But the law only protects workers from *known* hazards. It is by protecting workers against hitherto unknown hazards that the industry has earned its good record.

In I.C.I. more than £400,000 a year is spent on medical and nursing services and a further £90,000 a year on research to make sure than no man is harmed by the chemicals he helps to make. If half the total goes on work the Company is legally obliged to do, the other half represents the difference in cost between what it is obliged to do and what it does.

Day-to-day treatment at the works surgery is the visible peak of an iceberg-like structure that extends far deeper. The unseen nine-tenths of the structure reach into the fields of research and prevention: research into the possible effects of chemicals on the human body, and the taking of the necessary steps to forestall these.

How is it done? Suppose for a moment that the research labs in an I.C.I. Division discover a new compound with commercial prospects. Before manufacture can even be considered a sample must be passed on to the Division Medical Officer. After making his own observations on it he sends the sample to the Company's Industrial Hygiene Research Laboratories at Welwyn, which can be regarded as I.C.I.'s medical research centre.

These laboratories, in their size and scope, are unique in the British Commonwealth, and you would have to look far round the world before you found their equal. At the laboratories there are two guiding principles: that a chemical is guilty until proved innocent, and that the only effective way of assessing its toxicity is to put it to test.

This is because the influence of chemicals on the human body is still very incompletely understood. A glance at the chemical formula of a compound will tell you very little about its effects on the body if it is swallowed, inhaled, or absorbed through the skin. A function of the body called metabolism is capable of breaking down compounds, re-forming them with chemicals already in the system, and producing something that may destroy a vital organ. On the other hand, it may break down a toxic compound and convert it to something harmless. An extreme example is the peculiar metabolism of the rabbit, which allows the animal to eat belladonna without ill effects, although the flesh of a rabbit that had eaten belladonna might poison a man. Similarly, although one or two chemicals are known to be carcinogens—that is, to give rise to cancers—carcinogenetic properties may lurk in other substances which bear no chemical relation to them. The fact that every new compound is an unknown quantity throws a heavy responsibility on the Industrial Hygiene scientists.

The sample comes to them from the Division accompanied by a description of its chemical and physical properties and known hazards to health, and an indication of whether process workers would be likely to come into contact with it during manufacture—by touching it or breathing in its fumes, for instance.

The Industrial Hygiene experts' job is to measure the sample's possible or probable effects on man. Its formula or physical properties can tell them little about this, and it would obviously be impossible to experiment on human beings when possibly fatal poisons were involved. The only alternative is to use animals. The laboratories are recognised by the Home Office, the staff are licensed to carry out experiments on animals, and the well-being of the animals is scrupulously safeguarded.

Tests on Rats

The sample is usually given first to a group of rats—a group because the response of individual rats to various compounds will vary greatly, just as it does with humans. The reaction of the animals is tested in three ways. The chemical is fed to them, injected into them, and applied to their skin. These tests parallel the three ways in which man can absorb poisons.

The results of the animal experiments are then translated into concrete terms, with enormous safety margins added. If a rat suffered harm only after 1000 parts per million of the chemical were introduced into its atmosphere, the resulting maximum allowable concentration for man might very well be 1000 divided by 100 or more, and a similar safety margin would be added to the harmful dosages by ingestion or skin absorption.

Duplicating Experiments

Sometimes it is necessary to duplicate the experiments with other animals—the example of the rabbit's tolerance of belladonna illustrates the need for this. Where agricultural chemicals are concerned, such as weedkillers, it may be necessary to test the effects on such animals as sheep.

To the Division's question "Can we produce this chemical without risk to life or health?" the answer from the laboratories is very unlikely indeed to be a

Laboratory tests—*on blood samples, for instance—are one of the means used to confirm that preventive measures on the plant are doing their job of protecting the workers*

simple yes. Whatever the result of the toxicology tests, the answer is almost certain to be "Yes, if . . ." Yes, if the maximum allowable concentration we have laid down is strictly observed on the plant. Yes, if the customers are warned of the skin contact hazard.

There are likely to be a number of these "ifs." On the other hand, the answer may be a categorical "no," and some commercially promising chemicals may never go beyond the research stage because the risk they offer to life and health is unacceptable.

Not only must the safety margins for harmful and lethal dosages be very great indeed, but possible long-term effects, not easy to judge in animal experiments, have to be taken into account. Safety recommendations may include routine X-ray and clinical examinations for all workers on the plant.

The safety recommendations now go back to the Division M.O. His job, in consultation with management, design engineers and the Safety Department, is to see that they are incorporated into the plant, first on a pilot scale, then on the full scale. He must also work out the safety precautions for individuals, such as protective clothing, where these are necessary, and ensure that the workers use these precautions and understand the reasons for them.

The design of the plant may be more elaborate because of the need to suppress dust or fumes or in some other way keep the chemical from human contact. Take the extreme case of a chemical for which the maximum allowable concentration in the atmosphere is 5 parts per million. It will mean a totally enclosed plant, contained in a building that is air-conditioned. Even then it cannot be *assumed* that the atmosphere is uncontaminated. A detector will be incorporated into the air exhausting system to show by a colour change indicator if the air is contaminated beyond the limit. For less extreme cases hourly checks of the atmosphere are made with instruments specially designed by the Industrial Hygiene Research Laboratories. These make it possible for an unskilled person to sample the air and read off any contamination in parts per million. Sampling of the air is carried out, too, of course, in plants involving chemicals proscribed as dangerous by factory legislation.

Safety for the Public

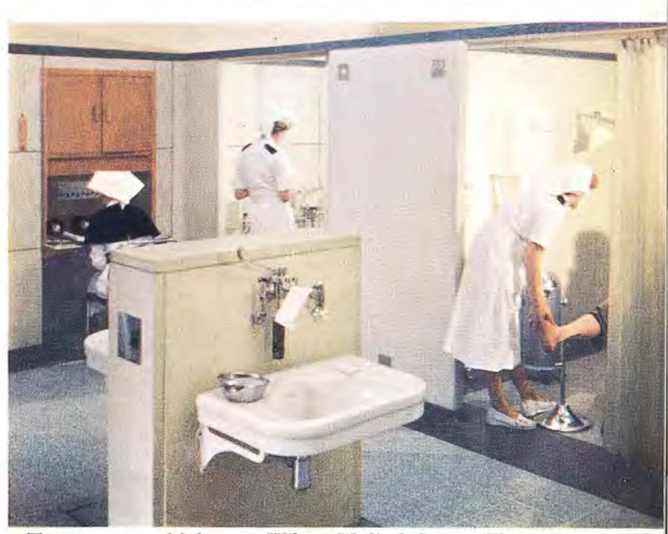
Of course, the Company also has to think of the people who use our chemicals. When a product is known to be toxic, customers are told so, and if it is very toxic they may be told that they cannot buy it unless they comply with the recommended safety precautions. Even the housewife with her detergent and the farmer with his insecticides and fertilizers have to be thought of. I.C.I. is very conscious of its responsibility to such members of the public, and to the research work which is necessary to ensure safe manufacture there must often be added special research to protect consumers. Food dyes, for instance, must be free from the faintest suspicion of toxicity, and to ensure that they are, rats will be fed massive doses of dye for long periods. Part of the dye is excreted unchanged, but part is broken down in the process of metabolism, and the breakdown products must be identified lest one of them be harmful.

Safety for the Worker

What is an acceptable risk in factory environment? The possible long-term carcinogenetic effect of cigarette smoking, readily accepted by millions of people, is a risk of a magnitude that would be quite unacceptable in I.C.I.'s code of standards for factory environment. This code is not based on any single criterion, but the final result of the care and thought that stem from I.C.I.'s medical services is that a man working on a plant in close proximity to "dangerous" chemicals is protected from health risks far more effectively than he is able to protect himself on his day off.

The Company's object is to eliminate risks as far as humanly possible. These risks are eliminated not only at the research and design stages but by constant medical supervision of all processes where harm might conceivably arise.

In I.C.I.'s largest *and most up-to-date medical centre, at Wilton, employees wait their turn for treatment*



Treatment cubicles *at Wilton Medical Centre. The centre, opened last year, caters for* 12,000 *employees and has over* 1500 *attendances a week.*
(*Below*) **The radiographer** *consults a doctor at the Castner-Kellner Works of General Chemicals Division.*

People and events . . .

Antarctic Test for I.C.I. Products

BACK in London after their impressive feats in the Antarctic, Sir Vivian Fuchs and members of the Transantarctic Expedition were full of praise for the materials given to the Expedition by I.C.I. These included 'Terylene' pillows, blankets and sleeping bags; coated 'Terylene' tarpaulins, Sno-cat covers and groundsheets; 'Terylene' sledge towing ropes and guy ropes; 'Fluon' for sledge runners; silicone rubber; 'Perspex' sheet, and low-temperature explosives.

Sir Vivian Fuchs used a 'Terylene' sleeping bag throughout the expedition. Its great advantage was that it absorbed very little moisture, and it could easily be dried by hanging it in the tent over a primus stove. 'Terylene' bedding was used chiefly at the base hut, and the Expedition members found it easy to wash and dry.

* * *

Of the 'Terylene' tarpaulins, the most successful were the ones coated with 'Neoprene,' a synthetic rubber. They remained flexible even in the most intense cold. The 'Terylene' sledge towing ropes were a tremendous asset, according to the Expedition's stores officer, Mr. David Stratton.

Three-inch rope was used as a safety line between Sno-cats, and when the leading vehicle fell into a crevasse, as happened often, the rope stretched slightly before taking up the strain. In similar circumstances a wire rope would have parted. Smaller 'Terylene' ropes with less stretch were used successfully by the Expedition for mountain climbing.

The Expedition brought back some impressive figures to illustrate the advantages of coating sledge runners with 'Fluon' P.T.F.E. 'Fluon' causes very little friction with ice and snow, and much heavier loads were carried on the tractor sledges than would have been possible if conventional runners had been used. Dog sledges travelled farther and faster than before because 'Fluon' made the work lighter for the dogs.

When Sno-cats came to grief, 'Terylene' rope proved its worth

Exercise "Lion"

THE Commander-in-Chief, United Kingdom Land Forces, General Sir Robert Mansergh, was the principal of many important guests who visited Witton to witness a Civil Defence exercise in which more than 400 volunteers from all Divisions of I.C.I., the Regions and Head Office took part, together with token forces from the Mobile Defence Corps and the Birmingham Division of the Civil Defence Corps.

An overcast morning may have kept a few spectators away but more than 800 gathered on the parade ground, where three lines of smartly uniformed volunteers were drawn up for inspection. **Mr. R. A. Banks,** Personnel Director of I.C.I., opened Exercise "Lion" with a short speech. He welcomed General Mansergh and the Lord Mayor of Birmingham, Alderman J. J. Grogan, who had come to watch the largest industrial Civil Defence exercise ever to be held in this country.

* * *

The Lord Mayor was accompanied by a number of Birmingham Corporation officials and by senior officers concerned with Civil Defence throughout the length and breadth of the land. Mr. Banks apologised for the absence of the I.C.I. Chairman, **Sir Alexander Fleck,** and read a message from him of appreciation, encouragement, and good wishes for a successful day.

Spectators gathered for a short time in a covered enclosure beneath the commentator's stand, where **Mr. H. Prior** (General Chemicals Division) spent an exhausting but extremely helpful afternoon explaining what was going on in various parts of the exercise area. The story, as outlined by Mr. Prior, was that during the morning a nuclear explosion had occurred 15 miles downwind from Witton; we were on the fringe of the fall-out area but could work quite safely for about four hours.

Among the more spectacular incidents was a river crossing by a Nobel team, who safely brought a stretcher casualty across an improvised bridge. An explosion detonated on the ground floor of a derelict building startled the onlookers and provided the first-aiders with two serious casualties and a realistic corpse. A large fire which broke out was speedily and effectively dealt with by the Kynoch Works fire brigade, and a number of long-suffering casualties who had been buried beneath overturned lorries or under piles of rubble were eventually discovered, released and attended to. Throughout the afternoon a well-trained emergency feeding corps prepared a meal for some hundreds of spectators.

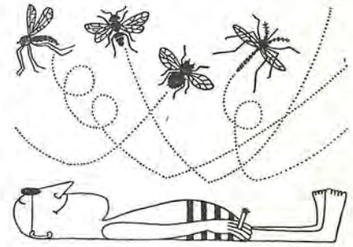
* * *

The Billingham heavy rescue team worked with such speed that the umpire decided to make one of their members a casualty; he was brought down from a high scaffolding by the hinged ladder method. Another incident which caused much interest was where a fractured gas main was reported. Some services volunteers arrived to deal with the break, and one of their number descended wearing emergency breathing apparatus. Unfortunately the air pipe was so placed that gas reached the would-be rescuer and two other people who went down to join him, and an impressive bunch of unexpected casualties was rushed to the first aid posts.

At the end of the exercise General Mansergh said he was very pleased and surprised at the efficiency with which the various teams had worked together: it was obvious that the training had been thoroughly understood. "As you probably know, I travel about the country quite a bit, and I have never yet seen anything of the size or, candidly, quite so good anywhere else in the country. Your work is excellent. I congratulate you all."

An End to Ouch!

"IT was a marvellous place, but we were nearly bitten to death." A new addition to Pharmaceuticals Division's range of household products seems likely to put an end to this woeful story of holidays ruined by biting insects.



'Flypel' contains what is considered to be the best all-purpose insect repellent so far developed. It will keep flies, gnats, midges, mosquitoes and other biting insects at bay, and is simple and pleasant to use. It is also antiseptic, so that if you are unfortunate enough to be attacked just before applying 'Flypel' it will help to prevent the bite from going septic.

'Flypel' costs 3s. a tube, and can be bought from chemists, ironmongers and garden shops.

Transatlantic Exchange

A HIGH degree of technical liaison is maintained between the Paints Divisions of I.C.I. and C.I.L. Recently, for example, a four-day meeting was held at Slough, when experts from both companies discussed the latest developments on both sides of the Atlantic.

Such meetings have been held before, and are supplemented by exchange visits. To strengthen the ties between the two Paints Divisions a new move has now been made. **Mr. P. R. Day,** C.I.L.'s Research Supervisor for exploratory and long-term research on paints, has come to this country for two years as an assistant research manager of I.C.I. Paints Division. In exchange, **Mr. E. E. Connelly** of I.C.I. Paints Division has gone to Canada to take up Mr. Day's job for two years.

Mr. Day was born in Bulawayo, Southern Rhodesia, and joined the Paints Division of C.I.L. in 1951 after graduation as a Bachelor in Applied Science with first-class honours at the University of Toronto. He is well known in C.I.L. for his work on 'Dynakote,' the latest C.I.L. development.

Mr. Connelly, a group head in the Development Department of I.C.I. Paints Division, graduated from the University of Birmingham with first-class honours in chemistry in 1936. He joined I.C.I. in 1937 after working for a year with the City of Birmingham gasworks.

Ardeer Men sail for India

JUDGING from the response to a call for volunteers to start up the Indian Explosives factory at Gomia, the spirit of adventure is still very much alive in Nobel Division.

Thirty-seven men were chosen to sail for India on 31st May. They had an average I.C.I. service of no less than 18 years, and one, **Mr. John Dempster,** had worked at Ardeer for 31 years. He has gone to Gomia as an instructor for men working in the blasting danger area.

At a send-off party for the men, **Dr. J. M. Holm,** a managing director of the Division, explained why I.C.I. had accepted the Indian Government's invitation to build the Gomia factory: "We realised that if we did not build this factory some other country would do so. Germany, Italy and Japan were all mentioned in that connection. So whatever happened Nobel Division would lose a very valuable trade in India, and it was realised that it would be better for the Company to build the factory and still derive some benefit."

It is hoped that the official opening

of the factory will be on 5th November this year—five years to the day from the time when I.C.I. signed the agreement with the Indian Government.

Learning Russian

A RECENT issue of *The Times* scientific supplement *Technology* contained an article entitled "Sampling Russian Steam." The author is **Mr. J. Jackson** of Chemical Engineering Services Department at Head Office.

How did Mr. Jackson find out what the Russians are up to? By teaching himself Russian and digging out the facts in Soviet technical papers and pamphlets.

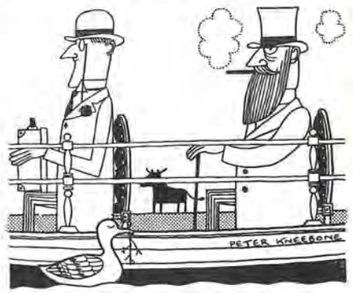
It has taken him less than a year to master enough Russian to read technical literature. "If you want to read Tolstoy or Dostoievsky," says Mr. Jackson, "that is a much tougher job." Russian, he admits—and he has a working knowledge of no fewer than ten languages—is difficult, but he thinks the difficulties are often exaggerated. Cyrillic script, particularly, is less of a stumbling block than most people suppose.

"Valuable as translations may be," wrote Mr. Jackson in *Technology*, "the individual technologist needs to be able to read the Russian material in which he is interested without having to rely on, and wait for, the making of translations."

Old Westquarter

VISITORS to Nobel Division's Westquarter factory, where detonators are made, go by road these days. Half a century ago there was a picturesque alternative: you could travel on the Union Canal from Linlithgow in a white launch with red plush seats.

Probably few people can remember doing this. One of them is Mr. W. G. Ibberson, who has a family cutlery business in Sheffield. His father supplied Nobels Explosives Co. with the long, double-handed knives used for cutting cordite and the knives used at Regent Factory to cut safety fuse. Ibberson's also designed and made for



Westquarter a tool which cut safety fuse and fastened it into the neck of the detonator. Crimpers for this purpose are still being made at their Sheffield works.

As a boy Mr. Ibberson made several visits to Westquarter and Regent Factory at Linlithgow. He recalls that the delicacy of young swan meat was not unknown to some poachers around Linlithgow Loch, who had a cunning and completely illegal way of killing the young birds. They would float out an electric detonator concealed in a piece of bread. What happened afterwards was simple and lethal. Fortunately this practice has died out, and those who poach the swan do so at grave risk.

PEOPLE

Mr. Henry J. Trickett, a representative of Metals Department, Southern Region, received the honorary freedom of the Borough of Sutton and Cheam recently in recognition of 27 years of public service. He was mayor of the borough in 1945.

Sir Alexander Fleck has received the honorary degree of Doctor of Science from Nottingham University.

Mr. Bernard Kelly of Leathercloth Division, Hyde, was a member of a panel which discussed crown green bowling on the B.B.C.'s Network Three. He has twice won the Blackpool Waterloo Bowling Handicap.

Sir Alexander Fleck and **Lord Chandos,** one of I.C.I.'s non-executive directors, are among the trustees of the proposed new Churchill College, Cambridge. The college is to be devoted predominantly to the advancement of science and technology.

Two junior members of Billingham Synthonia gym section, **Alan Jones** (14) and **Lloyd Readhead** (15), came fourth and fifth in the Amateur Gymnastic Association's national final on 10th May.

Miss Jean Layden of C.I.L.'s Employee Relations Department is a member of the Bell Telephone Co. concert party which regularly visits far-off outposts entertaining the troops. Her latest trip took her inside the Arctic Circle—to the R.C.A.F. North Pole station at Resolute Bay, north of Baffin Island.

Mr. John Pilbeam, I.C.I.A.N.Z. Safety Officer, has been elected deputy chairman of the Victorian Government's Safety Convention to be held at Melbourne University next December.

In local elections at Stevenston two Ardeer men were elected. **Mr. J. Lumsden** defended the seat he has held for five years and has been appointed junior bailie. **Mr. T. H. Hyslop** regained the seat he lost last year.

When the Queen visited Woolwich Barracks to see a display of new equipment, **Mr. William Gardiner,** a turbine operator at Billingham, was a member of the guard of honour. He is president of the Tees-side branch of the Royal Artillery Association.

Mr. Thomas Andrews, a maintenance fitter in Plastics Works, Billingham, and a member of West Hartlepool Council, was elected an alderman at the recent annual council meeting.

Mr. N. B. Joubert, who works at A.E. & C.I.'s Umbogintwini Factory, has been awarded an additional £468 for a suggestion made during 1957. This brings the total value up to £518. His suggestion eliminated the need to purify trichloroethylene for the manufacture of perchloroethylene in the plant where he works.

Billingham Synthonia Angling Section's two senior awards for the heaviest catch and heaviest aggregate catch in a series of matches went this year to a novice, **Mr. W. B. Campbell** (Nylon Works instrument artificer), who took up angling only a few months ago.

Dr. R. Beeching (I.C.I. Technical Director) is a member of the study group set up by the British Association to investigate the consequences of a changeover to the metric system in Britain. The group is under the chairmanship of Sir Hugh Beaver.

Six members of Dyestuffs Division's motor cycle and car club at Blackley, **Messrs. Thorpe, Mitchell, Boothman, Mellor, Schofield** and **Richardson,** were members of a scooter team which took part in the 1958 Isle of Man international motor scooter rally last month.

Order of the Bath

ABOUT eight years ago an enterprising firm of Australian plastics fabricators named N. V. Appleton started making 'Perspex' baths. In direct competition with enamelled iron baths imported from England, the 'Perspex' baths made considerable headway in the market. Apart from being less expensive than iron baths they were much lighter and could be shipped across the continent in freight aircraft at economic rates.

The 'Perspex' bath idea has now caught on in Britain. Thermo-Plastics Ltd. of Dunstable are making them, at prices ranging from £17 to £30. While a white-enamelled iron bath costs only about £13, coloured ones are very costly to produce. 'Perspex' baths can be made in a wide range of colours at no extra cost. They have the added advantages of conserving the heat of the water for a longer period than iron.

Old-established Agents—2

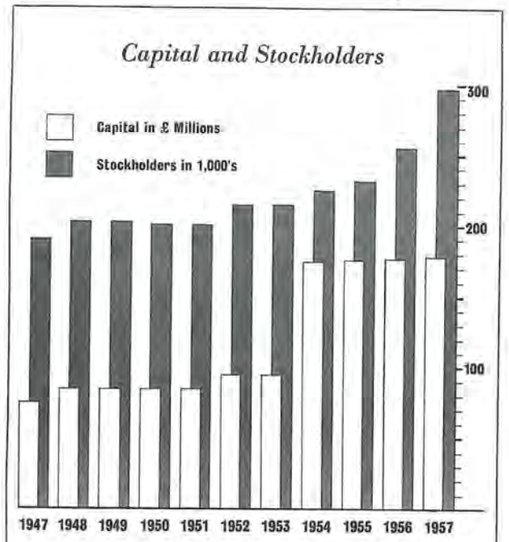
IN 1917 three brothers founded a very small company, International Agencies, in San José, Costa Rica. They were Edward, Rudolph and Oswald Sasso, sons of parents who had come to Costa Rica from the Virgin Islands.


Mr. E. Sasso

In 1922 the Sassos started representing the United Alkali Co. Today International Agencies handles all the I.C.I. chemicals, dyestuffs, leathercloth, metals, pharmaceuticals and plant protection products sold in Costa Rica, and the brothers have four of their sons working in the business.

Sheer hard work has enabled the Sassos to weather many an economic storm, and their reputation for fairness and honesty has won and kept them customers who now look to them for more than just a square deal. To many customers Edward Sasso, particularly, is someone in whom they can confide their troubles.

The Sassos are keen businessmen—one of their most remarkable achievements has been to boost the *per capita* consumption of boot polish in Costa Rica to the highest in the world. But they are not so keen as wags in San José suggested five years ago, when they said that Edward had gone to London to collect his commission from I.C.I. There was no malice in the remark, for it was well known that this member of the Sasso brothers was visiting London to see the Queen's coronation and to be entertained by I.C.I.



NEW share issues subscribed for in cash by stockholders and scrip issues made out of undistributed profits have increased I.C.I.'s capital from £74½ million to £178 million in the last ten years. At the same time the number of stockholders has risen from 190,000 to nearly 300,000, some 43,000 of these being I.C.I. employees.

"Capital" here means issued share capital. Behind this lies some £171 million reserves belonging to the ordinary stockholders and employed in the business. £72 million of these reserves are being capitalised by the new scrip issue. Also invested in the business are loans of £90 million.

Revaluation

IN the course of his speech at I.C.I.'s Annual General Meeting, the Chairman told stockholders that the Company's manufacturing assets in this country had been revalued. Their net book value as at 1st January 1958 was £396 million—£70 million more than at the last revaluation in 1950.

Sir Alexander explained how the figure was arrived at. An estimate was made of what it would cost to erect the plants today. This gave a figure of gross replacement cost, which was then reduced to take into account the fact that the plants are not new.

The remaining useful life of each plant had been estimated so that the annual rate of depreciation could be determined. The additional depreciation to be incorporated in the 1958 accounts, said Sir Alexander, was somewhat lower than might have been expected, because many plants were now considered to have a longer economic life than was originally estimated.

One effect of the revaluation will be to put into proper perspective the return that Ordinary stockholders are getting from the total of their funds in the Company. Much of the capital was put in when the pound was worth more than it is today, so that the gross

Ordinary dividend expressed as a percentage of the total funds belonging to Ordinary stockholders overstates the actual return.

Better Service

BETTER service to customers will be possible now that Paints Division's Technical Service Department is housed in a fine new building at Slough. Until recently the department has been short of space and its members have been scattered in six different buildings.

The main block of the new building houses the various practical sections of the department—pretreatment, industrial, motor manufacturers and refinish, commercial transport, wood finish, decorative and marine. Two training rooms and a lecture room have been set aside for trainees from these trades.

A two-storey wing adjoining the main block holds administrative offices downstairs and the Colour Advisory Department upstairs. The Colour Advisory staff have the benefit of an enormous north-facing window.

* * *

Members of the laboratory staff who are normally working at a distance from a telephone carry "fountain pen" radio receivers much like those used by doctors in many hospitals. When the telephonist in the reception hall presses a button the receiver emits a signal, telling the wearer that he is wanted on the telephone.

Survey

THE fate of 100,000 paper clips was traced in a recent survey in Washington. Here are the results: used as pipe cleaners, 5308; became toothpicks or ear scratchers, 5434; served as stakes during card games, 19,413;

broken or twisted during boring conversations, 14,163; used as makeshift hooks or to replace buttons and cufflinks, 7300.

One-fifth of the 100,000 were used for the purpose for which they were made. The balance, apart from those listed above, were paper clips which had been dropped on the floor, swept up, swallowed by small children, or left lying about in drawers.

NEWS IN BRIEF

Aid for Oxford. I.C.I. is giving £2000 a year from 1958 to 1964, under covenant, to the Oxford Historic Buildings Appeal.

Syrian Ban. I.C.I. has been banned from activities in the Syrian region by an order signed by the Syrian Economy Minister. The reason given is that I.C.I. has invested capital in Israeli companies.

C.D. Volunteers. Fifty volunteers from Nobel Division's Sabulite Factory have attended a Civil Defence wardens' training course.

Five Flags Flying. For the first time since the start of the safety incentive scheme at Wilton five "half a million hours" flags have been flying at Piccadilly Circus, Wilton. This milestone was reached on 12th May, when 'Terylene' Works hoisted their flag for the fourth time.

'Alkathene' for Dounreay. 'Alkathene' pipes are being laid in the underground drainage ducts which will carry out to sea the wash from laboratories and decontamination units at Dounreay atomic power station on the north coast of Scotland.

Silver Medal. *Whispering Wings*, a 14-minute short film made by A.E. & C.I.'s Photographic Department, was awarded a silver medal at the International Sports Film Festival held in Italy. The film features a flock of vultures which accept a glider plane as leader.

Brussels Exhibition. The flags of the 48 states outside the U.S. pavilion at the Brussels Exhibition are made of 'Terylene.'

1066 And All That. A quick count round the table at a farewell dinner party for Mr. Ulrich Treloar, retiring I.C.I.A.N.Z. ammunition factory works manager, gave a total of 1066 years of service among the 57 guests present.

Cheaper Titanium. The price of I.C.I.'s wrought titanium and titanium alloy products has again been reduced. Reductions vary between 5% and 20%, depending on the form of the wrought product and the grade or alloy of titanium used.

Holiday Article Competition

THE *Magazine* is again offering a prize of £30 for the best holiday article submitted—Editor's decision to be final. All entries must be original unpublished work and should be received by us not later than 30th September, clearly marked "Holiday Competition."

Animal Lovers in India

"PUSSY," the resident cat in I.C.I. House, Calcutta, gave birth to three kittens not long ago in the office of the transport superintendent. "Pussy" was found dead shortly afterwards and the kittens were left without a mother. **Mrs. Doris Matthews,** secretary to the company secretary, has been feeding them ever since from a bottle.

Mrs. Matthews

Mrs. Matthews has been interested in animals since she was a girl, and in 1948 she started an organisation known as the All Lovers of Animals Society. The object of the society is to give free treatment to animals whose owners are too poor to afford the fees of veterinary surgeons, and about 2500 of these cases are dealt with every year.

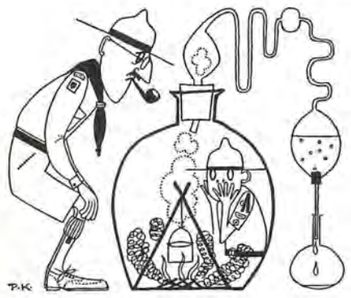
Money is raised by subscription from the 300 members, by donations, by jumble sales, and by an annual flag day collection. Last year the R.S.P.C.A. recognised the work of the society by sending out to Calcutta a van, which is now used for picking up stray and injured animals. Two full-time vets are employed in the society's clinic, and a hospital and boarding kennels for cats and dogs are to be started soon. Meanwhile Mrs. Matthews maintains a small home for animals out of her own pocket.

Mrs. Matthews was born in India but spent several years in England as a schoolgirl. Her husband, S. J. Matthews, was one of the leading tennis players in India in his younger days.

Prepared

A NEW proficiency badge which a Boy Scout can earn in Canada is that f chemist. The idea was suggested by a member of an Ottawa troop and details were worked out with members of the Chemical Institute of Canada.

To earn the new badge a Scout must satisfy a number of requirements which supplement chemistry learned



at school. Methods of water purification, demonstration of natural chemical processes observed outdoors and the working of fire extinguishers are a few of these.

New C.I.L. Paint

THE most significant advance in metal-coating technology since the discovery of alkyd resins was announced by Canadian Industries Ltd. recently.

The new discovery is 'Dynakote,' described as a new type of oil-free baking finish based on a cross-linked vinyl copolymer. It is expected to find a ready market in the U.S. and other parts of the world as a finish for household appliances such as refrigerators and washing machines.

'Dynakote' has many of the properties of both vitreous and alkyd-based enamels, such as resistance to grease, stains, detergents, soap and heat. Its great advantage is that it can be applied in a single coat, without a primer. The Frigidaire Co. in Canada, which is using 'Dynakote' for finishing refrigerators, food freezers, and some models of automatic washers and driers, reports spectacular savings achieved by this single-coat application.

The new enamel was discovered and developed at C.I.L.'s Central Research Laboratories in McMasterville. The work began ten years ago and has cost $700,000.

Stocks and Shares

ONE of the financial mysteries that often puzzles the man in the street is this: what is the difference between stocks and shares?

When a company incorporated under the Companies Act and having a share capital wishes to issue further capital, this by law must first of all be issued in the form of shares, and each share is numbered. When the company is the size of I.C.I. and has £216 million of share capital issued, the clerical work entailed in recording the distinctive number of each share on all transfers of these shares, and on the Share Register and Certificate, becomes an intolerable burden.

* * *

It is usual, therefore, for companies of any size to convert shares (provided they are fully paid shares) into stock immediately they are issued, as units of stock are not numbered.

For example, I.C.I. has recently issued 77,177,205 fully paid Ordinary shares of £1 each numbered serially, which became £77,177,205 Ordinary stock in £1 units. The units of stock have no distinctive numbers but in all other respects are identical with the shares as originally issued.

The difference between stocks and shares, in fact, is a legal one, and not so very puzzling after all.

Provost of Ardrossan

Mr. James Dorrian, a technical officer in Nobel Division engineering department, Glasgow, has been elected Provost of Ardrossan. He has been a member of Ardrossan Town Council continuously since 1948.

Mr. J. Dorrian

Following his success at the polls earlier in May, Mr. Dorrian was awarded this further honour by majority vote in the Council.

Before entering Ardrossan Town Council in 1948 he had an earlier experience of membership from 1937 until 1940, when he did not seek re-election because he had been transferred to work for the Company in Dumfries, where he remained until 1946.

Mr. Dorrian was invested with his robe and chain of office at a ceremony in the Council Chambers, Ardrossan.

First Footing

FIRST-FOOTING took on a new meaning at Wilton Medical Centre when **Mr. A. W. Weir,** Personnel Manager, inaugurated the chiropody service by being the first patient. A fully qualified chiropodist is now in attendance once a week, and treatment costs 3s. 6d. for one foot and 5s. 6d. for two.

NEW APPOINTMENTS

Some recent appointments in I.C.I. are: **Canadian Industries Ltd.:** Mr. G. H. Findlay (Development Manager), Mr. J. D. Wright (General Purchasing Agent). **Heavy Organic Chemicals Division:** Mr. J. S. A. Forsyth (Development and Technical Sales Service Manager). **I.C.I. (Export) Colombia:** Mr. S. B. James (Manager). **Marston Excelsior Ltd.:** Mr. C. L. M. Cowley (Joint Managing Director), Dr. T. A. J. Lamb (Factory Manager, Leeds), Mr. R. A. Rogers (Commercial Manager). **Metals Division:** Dr. J. A. Duncan (Division Medical Officer), Mr. A. D. Peel (Division Supply Manager). **Nobel Division:** Mr. J. C. B. Carnegie (Home Sales Control Manager). **Paints Division:** Mr. E. F. Brookman (Development Director).

Men with Ideas—6

Victor Mansell

IN his 29 years as chargehand in the packing department of Dyestuffs Division's Ellesmere Port Works Victor Mansell has seen many changes. Probably none of them has pleased him so much as the small but money-saving change which he thought of himself.

In the packing department 4 oz. tins are filled with indigo for export. As many as 12,000 a day are despatched to such countries as British West Africa, Persia, India and Greece.

Twenty-five years ago it took nearly nine hours to fill and box 200 tins. Now it takes 1½ hours, thanks to improved tins and automatic filling machines. But no system is perfect, and it was left to Vic Mansell to make a suggestion for reducing the cost of the tins themselves.

The tins, having pilfer-proof lids, are filled through the bottom, and the bottom is fitted with a lid which is sealed on by machine. Vic suggested that these lids, which had a groove and lip formerly used for sealing, could be made with a flat flange, since the machine curled the edge of the lip on to the tin in two movements.

The tin manufacturers agreed, took two operatives off the lip-forming process, and passed on the saving to I.C.I. Vic Mansell found himself with an unexpected windfall—a Suggestion Scheme award of £189.

(*Photos: Charles Scott*)

ZONE REFINING

By D. W. F. James (Widnes Laboratory)

Illustration by H. J. Eric Smith

The making of very *pure metals is a comparatively new technique. In part this is because only in recent years, with the development of ingenious devices like the transistor and with the development of atomic energy, has purity of the order of one part impurity in a million been needed.*

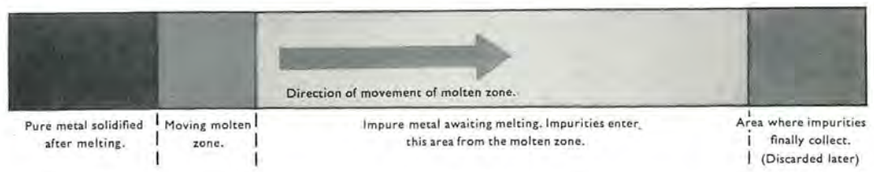
One of the wonders of modern science is the technique of zone refining, used to purify rare metals such as germanium needed for electronic devices like the transistor. Indeed, without the new methods of purifying metals it is doubtful whether the transistor could ever have become a commercial proposition. One transistor may use only about 0·001 oz. of germanium; and it is just as well the quantity is small, because pure germanium will sell for £$\frac{1}{4}$ m. per ton. Compare this with gold at £$\frac{1}{3}$ m. per ton. The United States and ourselves consume a few tons of germanium a year for the manufacture of transistors and other devices. So you can see that the making of pure germanium is big business, and it is likely to become even bigger.

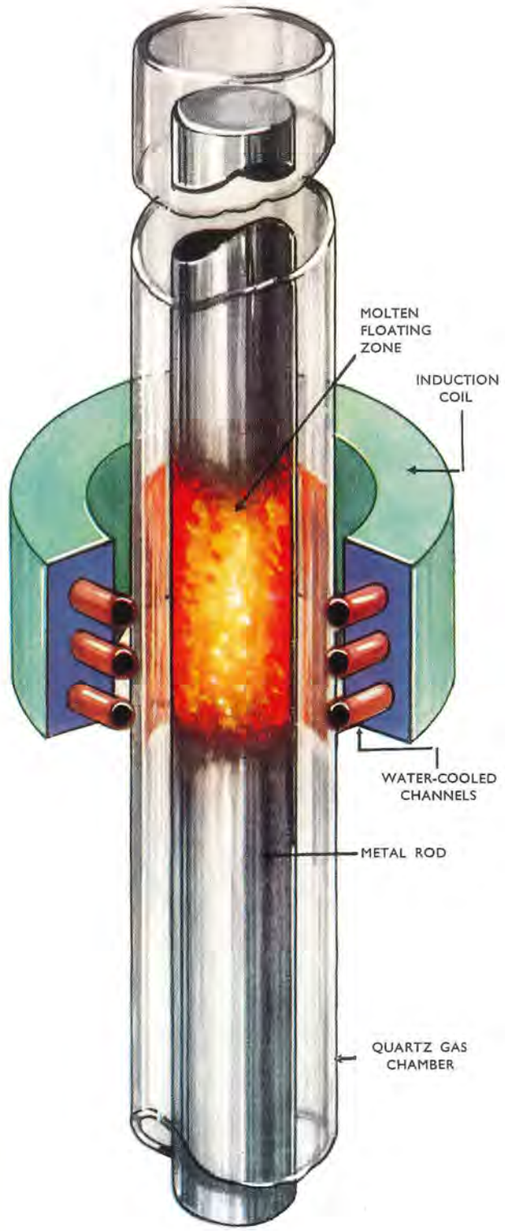
The man to whom the credit must be given for developing zone refining is Dr. W. G. Pfann of the Bell Telephone Co. of America. The principles of zone refining are really quite simple.

Suppose a mass of molten metal containing small amounts of impurities is allowed to solidify slowly. If the impurities are more soluble in the molten metal than in the solid—and this is usually the case—these impurities will tend to stay in the molten material. And if the metal is allowed to solidify in sections, one part being kept hot and another allowed to cool, the first metal to solidify will be purer than that solidifying later.

In zone refining a narrow molten zone is established in an ingot of the material to be refined, and this molten zone is then made to move along the length of the ingot. At the front end of the zone, solid material is melting; and at the rear end, molten material is freezing. At the freezing face, purified metal will tend to deposit, leaving most of its impurities in the molten zone. And as the molten zone is moved through the metal from one end to the other its impurities will gradually concentrate at the end of the ingot which cools last.

One zone pass will rarely be sufficient to produce a large improvement in purity, and a number of passes need to be carried out. The ease with which purification can be achieved varies from one metal to another and according to the impurities present. For some metals zone refining is very effective and only a few zone passes are needed to produce good purification. For others many more zone passes are needed. In all cases a limit is eventually





reached when further passes do not produce any improvement in purity. The end of the ingot, where the impurities are concentrated, is then discarded.

Usually, by carrying out enough passes, extremely high degrees of purity can be achieved in most metals. For example, impure gallium—containing about 500 parts per million of impurities—has been zone refined to give a very pure material. Seven impurities were detected after zone refining, but there was less than 1 part per million of each impurity present. In the case of germanium even better results have been obtained.

Several ways of carrying out zone refining have been devised. In the most widely used method the material to be refined is contained in a suitable boat—made say of silica or graphite—and is then drawn slowly through a number of heating units which produce molten zones in the material. These heating units may be simple resistance coils, small furnaces, or high-frequency induction coils. The type of heating unit used will depend, of course, on the properties of the material being refined. Because many metals react with air, often at temperatures below their melting points, zone refining is usually carried out in an atmosphere of argon or hydrogen or under vacuum.

Some metals, however, react with all known crucible materials. This has led to the development of "floating zone" refining. In this method a solid rod of material is clamped vertically between two suitable chucks. A molten zone is established in the rod by means of a high-frequency induction coil, and the zone remains supported by surface tension and by the electromagnetic forces from the coil.

Manufacturers of germanium transistors now regard zone refining as an essential part of their purification process. Germanium containing only one part of impurity in a thousand million has been made this way. Impurities cannot be detected by conventional chemical analysis at this sort of level and are determined by special electrical measurements.

Today many metals are being zone refined in order to assist studies on such phenomena as creep and fatigue. Some ultra-pure metals exhibit unusual properties; for example, zone refining of zinc produces large crystals which are quite flexible, and aluminium exhibits unusual properties in relation to grain size.

Zone refining is by no means restricted to metals. Recently it has been applied to organic materials with considerable success. For example, naphthalene containing 0·2% of anthracene has had its anthracene content reduced to 0·00002%. Other materials which have been zone refined include benzoic acid, pyrene, anthracene and morphine. The method is also being applied to materials exhibiting biological activity in order to see if the activity is due to the basic material or to any trace impurities present.

Recently the technique has been applied in atomic energy to remove undesirable impurities in new uranium fuel elements and to remove fission products from spent fuel elements.

Seconds Out

By Cedric Jagger

Seconds out—this is the standard of timekeeping accuracy which is the aim of the collector of veteran watches. But unlike his counterpart, the collector of veteran cars, he can keep several going at once, all for a few shillings.

THE collector of old watches has never been a particularly common bird. Indeed, before the first world war he was almost non-existent, while between the wars he was usually something of a dabbler. Mostly, he knew very little about what he was collecting, and he bought almost entirely on appearance and hardly at all on performance or mechanical condition. His watches went badly, if at all, and he couldn't have cared less, provided that they were lovely to look at!

This attitude—which, to their discredit, was also shared by some museums—is to some extent understandable, since it was still possible in those days to buy, very reasonably, prime specimens of the most beautiful watches ever made. With these, the products of the seventeenth century, the artist-craftsman had reached heights which have never since been equalled, let alone exceeded; the employment, during the first fifty years, of superb enamel work and exotic substances such as rock crystal, followed later by elaborately engraved and pierced metalwork, made this, decoratively speaking, truly the golden age of the craft.

Almost overnight the position changed. Watch collectors—horolophiles, if you prefer a specialist term—still talk with bated breath of a certain sale of a large and important collection in which prices doubled without warning. Since then, in common with all objects of vertu, the market has risen even more steeply, and shows every sign of continuing to do so. So far as fine seventeenth-century watchwork is concerned, it is true to say that the supply has pretty well dried up, and what few first-class specimens do appear change hands at fabulous prices.

Theoretically this might well have sealed the fate of the small collector. In fact, of course, he just surveyed the ground again, turned his back resolutely on the seventeenth century, and considered the later periods. Here at once was a stumbling block. Gone were his watches with the beautiful "coachwork" and elaborately decorated dials and movements, and in their places were very much plainer-looking watches—but often with far more complicated mechanisms. These mechanisms were in themselves a new challenge. In fact, it was high time that collectors started learning something about what makes watches tick!

Dent's, of "Big Ben" fame, *made this minute repeater about* 1850. *This under-dial view shows the complex repeating action.*

Out of this topsy-turvy situation has arisen an entirely different type of collector. A typical one will start with unbounded enthusiasm while still at school, for several schools now run courses in practical

Under-dial view *of musical and quarter-repeating movement by Piguet and Meylan, Geneva watchmakers, who first substituted a pinned disc for the familiar musical-box-type cylinder. Made about* 1810, *the watch's actual diameter is* 2 *in.*

horology as an extra-mural study. He reads as much as he can find of horological history, familiarises himself with the contents of as many public and private collections as he can, and he tramps into every likely and unlikely spot on the look-out for specimens. He doesn't confine himself to complete watches—indeed, he mostly expects to find just movements, broken out of cases which have been sent for melting, which, if they are worthy of it, can be recased. He doesn't expect to spend much money on his hobby, and for that reason he is pretty well up on prices. Finally, and of real importance to him, he now exists in sufficient numbers to possess his own society.

As recently as the end of 1953 I had the privilege of helping to found the Antiquarian Horological Society and I have served on its council ever since. A legally

William Gossage, *celebrated industrial chemist, patented this in* 1823. *Set up according to the directions in the outer case (left), it converts a pocket watch into an alarm clock. The first of his fifty-odd patents, it was his only excursion into clockwork.*

constituted non-profit-making limited company, with headquarters in the City of London, it already boasts an international membership of some hundreds. It exists solely to promote interest in and original research into the history of timekeeping down the ages, and to preserve fine specimens of clock- and watchwork and the allied arts. It holds regular meetings at the Science Museum in London, sponsors exhibitions, arranges visits to public and private collections and tours of horological exploration abroad, and publishes a quarterly journal, *Antiquarian Horology*, as well as other specialised literature from time to time.

But to return to our modern collector. He is not content just to sit and look at his specimens, be they complete watches or just movements; he will not be satisfied until they are cleaned and overhauled, performing every bit as well as when new. Here was another snag, for the average watch repairer, brought up on factory-made replacement parts, can be counted a dead loss when faced with a hand-made watch to repair. So, while there is still time to profit from the wisdom of the few really first-rate craftsmen who survive, some collectors have themselves become craftsmen of ability.

What sort of watches or movements does our modern collector seek? While he is on the alert for interesting specimens from any period—even from the seventeenth century, for every collector possesses both patience and optimism—he is most likely keeping one eye out for specimens from the early precision timekeeping period, that is from 1780 to 1830 or thereabouts. During this period all sorts of exciting experimental work was going on. The aim was to develop watches which really were timekeepers, accurate to within a few seconds a day.

His other eye will be on the look-out for "complicated" watches, that is to say watches which do more than tell the time. Usually these were not particularly good timekeepers—the gadgets incorporated into their mechanisms often effectively defeated the principal function of the watch itself. On the other hand, for sheer mechanical ingenuity and precision craftsmanship within a very small compass there is no other antique workmanship to compare. Complications on watches come in two principal kinds—extra dials which give such information as the state of the calendar, operated by additional gearing driven by the watch itself, and audible actions, such as striking and repeating watches, which require a complete secondary mechanism driven by its own spring.

So far we have dealt with two of our collector's eyes, but if he is worth his salt he will certainly have a third in the back of his head. This will be constantly watching for all the ancillary equipment needed to maintain a watch of bygone days, such as cut steel fob chains, watch keys, and the stands in which a watch was deposited on retiring to bed at night.

Finally, of course, our collector is constantly on the alert to reject the fakes and forgeries—which are not very common and hardly ever have any intrinsic merit—and also to eschew the inferior articles and the pure rubbish which are part and parcel of the later periods of watchmaking, for every craftsman wasn't a genius!

Back view of an hour-striking watch *of about* 1675 *by Solomon Bouquet, London. The count wheel, right of the elaborately decorated balance cock, controls each period of striking. This is also a very early example of a watch with a balance spring.*

Old watches turn up in the most unlikely places, and it might be amusing for a moment to trace the history of the ones illustrated. The musical repeater was found in a glass and china shop in Eastbourne, and cost 30s. The minute repeater was purchased privately from a bookbinder in Watford, and cost the same price. The Gossage alarm turned up in a saleroom just off New Bond Street and was acquired for £3, but included in the lot was a delightful French drum-shaped gilt alarm clock, which, if subsequently disposed of, would greatly offset this price. All these transactions took place in the last year. But had the seventeenth-century clock-watch also illustrated appeared recently, its present owner would not have got within shouting distance of it. Luckily I bought it in 1949. It cost me £7 10s.—and a number of lunchless days subsequently. It is complete with the most superb silver case, intricately engraved and pierced so that the sound of the bell can be heard, and is in first-rate condition.

Collectors of old watches have much in common with the lovers of vintage cars—having restored our specimens to good working order, we put them to use. Personally, I think we just have the edge on our automotive friends, however: our instruments are much more venerable, for watches had ceased to be craftsman-made long before the first car went on the road. In addition, while it takes a car enthusiast all his spare time and money to keep *one* vehicle running, the horolophile may have any number of watches in going order.

For myself, I have five watches in constant use—all of the early precision period. One of them, a pocket chronometer of 1814 by a fine craftsman, Robert Pennington, would easily outpace for accuracy any but the really expensive observatory-grade watches of today. The others, of which the youngest is a lever watch of 1827, are equal to the performance of any ordinary wristwatch. The only reason why I do not regularly carry even earlier watches is on grounds of performance—the eighteenth- and late seventeenth-century watches are very susceptible to errors due to variation in position and temperature. One of my very good friends, however, waged his particular part of the last war in the R.A.F. entirely on the timekeeping of a watch made in 1690!

And what of the future? As the supply of craftsman-made antique watches dries up—as of course it will do—I think attention is bound to turn to early efforts at mass production. Indeed, there are already signs that this is happening, particularly with American watches. The remarkable "long-winded" Waterbury, with its nine-foot spring which needs two hundred and forty turns of the button every day to wind it up, and which, with its components pressed out of junk metal, was originally given away free with a new suit of clothes, is nevertheless an astoundingly ingenious piece of work, and a good timekeeper into the bargain. There are many other examples which one could cite—certainly more than enough to keep the watch collector happy for many years to come.

Wilderness Holiday

By P. G. Harvey

Six p.m. at Dead Man's Pond was the rendezvous for a flight into the Newfoundland interior, where bear, beaver and caribou still live undisturbed by man.

To the transatlantic passenger Gander Airport is a welcome opportunity to stretch his legs and drink coffee before resuming his westward flight. But there is more to it than that. It is in fact the gateway to one of the finest holiday countries in the world.

Some months ago my wife and I received a most exciting invitation. We were to fly on from Gander to Mount Sylvester, some hundred miles to the south, where a hunting lodge was being built which would be supplied entirely from the air. Six p.m. at Dead Man's Pond, Gander, was our rendezvous, and our first sight of the tiny Beaver aircraft moored on that ill-named lake did not reassure us. However, the arrival of the pilot, who bundled us casually aboard, restored our confidence, and soon we were flying steadily southward over innumerable lakes interspersed with marsh and forest, keeping a sharp lookout for wild life. Before long we spotted a black bear ambling unconcernedly along a lake shore. Then a cry from the pilot of "Caribou!" was followed by a tight bank and turn as we swooped down to see them.

All too soon we were gliding gently in to land on Lake Kaegudeck, where we tied up below a log cabin set in surroundings of indescribable beauty. But it was no log cabin of childhood stories. Every modern comfort, from hot showers to a refrigerator, was to be found. Our pilot promised to return on Friday or Saturday, and until then for nearly a week there would be no communication with the outside world.

Early next day we set forth to explore the river, which ran south from our lake to an even larger lake several miles away. Dense spruce forest alternating with spongy marsh and the complete absence of tracks made progress slow. There was an abundance of game trails, but invariably leading off in the wrong direction. Clamouring noisy "yellow legs" advertised our presence, silent inquisitive grey jays perched only a few feet away to examine us, tiny sandpiper chicks scuttled along the shores of the river, pie ducks and goosanders rose from the lake, and stately squadrons of Canada geese, incapable of flight at that time of year, paddled swiftly away at our approach.

The hunting lodge *at Lake Kaegudeck relies entirely on the Beaver aircraft for supplies*

That evening we turned our hand to fishing. Here were so many trout unschooled in the ways of the angler that even the beginner could not fail to land a respectable catch. Soon there were enough trout

Dense spruce forest, *alive with game, surrounds the trout-filled rivers*

caught to feed an army, but we remained at the water's edge until mosquito attacks and falling darkness drove us stumbling back to our cabin.

Next day two of the cabin builders agreed to ferry us across the lake in a canoe so that we could attempt the trek to Mount Sylvester.

The day started well. As the canoe approached the creek where we were to land, a magnificent flight of wild geese rose from the water; and as we slid into the mouth of the stream a school of otters broke surface in front of us, tumbling and whistling happily. We arranged a rendezvous with our boatman and set out on a route to the mountain outlined by our boatman in an accent so unintelligible that we gathered only that at some time we should pass the skeleton of a moose.

For the first hour we forced our way upstream. The brooding silence was overbearing, and unlike the previous day we met few birds. A brief sight of the mountain enabled a compass bearing to be taken, and in another half-hour we were complacently standing by the bones and antlers of the moose. The mountain was now clearly in view. There remained a couple of miles of dense forest to negotiate, and then we skirted a lake and climbed to the summit—a mere 1250 ft. quickly scaled but rewarding us with a tremendous view of uncharted country. With binoculars we scanned the surrounding forests and lakes without detecting a single sign of the works of man.

Returning to the rendezvous, we watched the antics of a family of beaver whose home was a large "lodge" on the edge of the stream. Papa emerged and declared the coast clear, whereupon three youngsters followed and the family cruised up and down until one of us revealed our presence. The head beaver gave a loud warning splash, and then they were gone. We came across considerable evidence of beaver woodcutting activities. Birch trees with ten-inch trunks had been sawn almost through and stood poised ready for felling; neat billets had been cut from logs with a regularity worthy of an axe and littered the lake shore.

Next day, which was sultry and hot, we set out in the canoe to look for caribou on the shores of the lake. After cruising several miles we at last detected through binoculars a small herd resting on a sandy beach. Luck was with us, for a strong offshore breeze prevented the caribou winding us, and we approached to within 30 yards with the outboard motor still running before three of them—two hinds and a stag—made off into the forest. The fourth, a calf, was consumed with curiosity and cantered happily up and down the beach.

Our remaining days were spent in further exploration and fishing—an existence so idyllic that the sound of an approaching aircraft on our last day tempted us to run away and hide in the forest. For all too brief a stay we had been pioneers in an unknown country.

INDIA PLANS BIG BUSINESS

By A. J. Maier

A vast scheme of imaginative planning is beginning to take shape in India 145 miles south-west of Madras. Here at Neyveli the overburden of soil is being removed to prepare for gigantic opencast lignite mining. With this will be integrated a power station fed by water pumped from below the lignite, an irrigation scheme, and the manufacture of nitrogenous fertilizers and other chemicals.

One hundred and forty-five miles to the south-west of Madras lies the town of Neyveli. The road to it is not unlike a French one: straight for miles, a good metalled surface in the centre and unmade at either side. As the horn sounds to warn the strings of bullock carts on the crown of the road, their drivers simultaneously wheel into the camber with the precision of gun limbers executing a musical drive.

The name Neyveli will not be found on any except the most modern maps, because it is only in the last year or two that it has grown up out of the paddy fields to be a township of 10,000 houses with schools, markets and a hospital. As a new town it does not, of course, have the international cachet that the name of Le Corbusier has lent to Chandigarh, the new capital city of the East Punjab, but, in due time and in its own way, Neyveli will also make its mark. Its fame will rest not upon its architecture, but upon the completion of an imaginative industrial venture conceived on the grand scale. This venture is the Neyveli Lignite Project.

Lignite, or brown coal as it is sometimes called, is generally regarded as being part of the way along a time scale which has peat at one end and coal at the other. Two and a half tons of lignite has roughly the same calorific value as a ton of good coal. The lignite deposits around Neyveli are now known to extend for 100 square miles and are believed to amount to two thousand million tons.

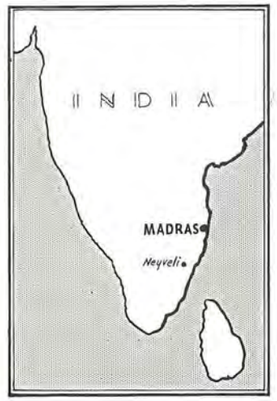
The exploitation of such a massive deposit of fuel in a country whose main industrial effort is directed towards increasing its energy resources could in time alter the basic character of the economy of Madras State. Blessed with two monsoons a year, Madras has always been a predominantly agricultural region. But monsoons can fail, and the search for water in India never ceases. It was on a series of such searches for artesian water that the deposits were discovered.

One serious obstacle stands in the way of their easy exploitation. The artesian water exerts an upward thrust of some 6–8 tons per square foot on the lignite and the overburden which lie above it: the geological association of lignite over water is believed to be unique to Neyveli. Experts decided that a carefully designed pattern of wells could theoretically deal with the pressure of the artesian water, and so reduce the risk of flooding when the overburden was removed.

Earth-moving equipment *in action at Neyveli. Alongside, an Indian carries a pitcher on his head in the traditional manner.*

Before the practical pumping tests had been completed, the Government of India, who by then had taken control of the project, took the calculated risk of putting out tenders for earth-moving equipment and specialised mining machinery. It was a bold move to make, and those in charge of the scheme are confident that this time-saving gamble will pay off.

The scheme, which Mr. Nehru inaugurated in May 1957, is described as an integrated project. All that this favourite phrase of planners means is that each part of the scheme as a whole supplies some essential requirement to another part.



For example, the backbone of the project is the winning of the lignite by opencast working. The lignite will be used to fire the boilers of a 200 megawatt power station. Part of the generated power will be fed into the Madras State electricity grid and part used for the other plants that form the project, including the operation of the pumps, 48 of them each pumping 1000 gallons a minute to reduce the pressure below the opencast working. The water pumped into a reservoir, formed by the spoil from the workings, will provide the power station's own large requirements and the needs of the town; what is left will be used for irrigation.

The power station is only one piece in the complicated jigsaw of interrelated plants; a fertilizer plant producing 70,000 tons of nitrogen as urea and a briquetting and carbonising plant to produce 380,000 tons a year of carbonised briquettes together with other carbonisation products, including tar, benzole and phenol, are the other principal features of the scheme. A good-quality china clay, removed during the opencast operations, will also ultimately be marketed.

We had been warned by those who had most recently visited Neyveli, some six months before, that there was little more to see than a hole in the ground looking much the same as any other hole in the ground. But on the occasion of our visit there was very much more.

Arriving at the headquarters, we embarked in a column of jeeps on a tour which took us first through the new township. We sped past workers' accommodation and bungalows for technicians and senior staff. Gardens round the houses were beginning to take shape, and brash young banana trees were putting out their tattered fronds. We drove straight through the maintenance workshops, large hangar-like buildings full of heavy earth-moving equipment, and then, after a quick look at the pilot quarry, the "hole in the ground" from which the first samples had been taken for analysis, we reached the working area.

A cut a mile and a quarter long has been opened in the earth's surface. From our viewpoint through the dust and heat haze we could barely see the far end of the cut in the distance. On the skyline, like a small boy's Dinky toys, a procession of tractor-drawn dumpers removed the spoil and formed up, empty, to wait for the next load from the excavator, keeping up a smooth rhythm of operation.

The removal of the overburden which has been going on for six months will go on for another two years before the lignite is exposed for opencast working. By 1960 two giant bucket-wheel excavators will be winning lignite at the rate of three and a half million tons a year. The most accessible and easily worked deposits amount to about one-tenth of the whole, and so at the planned rate of development they alone will provide nearly sixty years of working. The mile and a quarter cut is the first of a series of spokes radiating from the hub which will be the centre of the working. When the first cut has been worked out the spoil from the second cut will be transferred to it, and so the work will go on until the full circle has been completed.

There is another sense in which Neyveli is an integrated project. The mining consultants are the British firm of Powell Duffryn, the power station is to be Russian designed, and the specialised mining equipment will come from Western Germany. But the co-ordination of effort and the drive behind it are Indian. It was this as much as anything that impressed us. The quiet confidence of the directing staff could not conceal the enthusiasm and sense of mission with which the work is being carried on. The immediate objectives are the production of power, fertilizers and fuel.

The last is especially important when one remembers that 225 million tons of cattle dung which should be enriching the soil of India is yearly dried and burnt as a domestic fuel, equivalent to roughly 50% of the total energy consumed in the United Kingdom. Nevertheless, in pursuing these immediate objectives the authors of the scheme have not lost sight of the glittering rewards that could be theirs. Given a suitable lignite coke, the iron ores in the Salem district of Madras State could be developed. The additional tar produced in consequence might be hydrogenated for the production of motor fuel. Plastics, pharmaceuticals and insecticides—in fact a whole range of chemical products—are locked up in Neyveli's lignite.

WORK STUDY SPREADS ITS WINGS

By a special correspondent

I.C.I. has deliberately adopted the policy of making known to others the special techniques which the Company has developed in the use of Work Study. The result is that today Work Study has spread far beyond the confines of industry—into the Services, into agriculture, into the hospitals, and into the railways.

In the last few years there has been a considerable increase in the use of Work Study techniques outside industry. The application of these techniques has swept through the fighting services, bringing some spectacular economies which can be regarded as a foretaste of things to come; and in agriculture, too, there have been some remarkable results. A cursory survey of this progress towards greater efficiency brings out some telling statistics.

Navy. Joining routine for a sailor overhauled. Instead of filling in forms and giving information to one official after another, a recruit now completes all necessary paper work in one place. Work Study applied to engine change refits: time reduced from 79 to 20 hours. Harbour craft routines, barrack cafeterias and even "spud-bashing" routines are being reorganised, a typical instance being the eight-day work study done by three men in the mail room of the Royal Naval Barracks at Chatham. The total cost of the study and a small amount of equipment necessary to the improved method was £145; but the savings in wages alone, resulting from the reduction of mail room staff from twelve to three people, amounted to over £4000 per annum, and among the by-products was 100 sq. ft. of office floor space made available for other purposes.

Army. Over 300 Work Study officers will be at work by the end of this year. A R.E.M.E. Base workshop team showed after Work Study a total annual saving of £22,540. In a Royal Ordnance Depot stores supplying 50,000 items and with a staff of 377, an investigation by three men for six months resulted in a 50% reduction in documentation throughput time, a staff reduction of 33% and considerable economies in stationery—a total saving of £80,000 per annum. A survey of the overhauling of Centurion tanks proved that improvements could be made in space and labour utilisation and £300 saved on the programme. A Royal Engineers Work Study team is working with the architects at present planning the rebuilding of Knightsbridge Barracks. Purely military matters such as gun drills, bridging drills and regimental fatigues are being work studied.

Air Force. Thanks to Work Study, a Hawker Hunter is now serviced in 13 minutes instead of 19, using 4 men instead of 10. Arrangements for handling R.A.F. and other passengers and freight have been speeded up, and plans for new buildings cut from £500,000 to £140,000. Better use of existing accommodation, recommended after Work Study surveys, has in some cases done away with the need for new buildings.

Hospitals. The Central Syringe Service of a large London hospital group was recently investigated by two Work Study officers. After survey they recommended minor modifications in the layout of the Syringe Room costing £100. These changes are at present being implemented. Savings are estimated at £1500 per annum. Syringe Room staff can be reduced from five to three and all week-end work and overtime eliminated. Similar results were obtained from trial studies in hospital laundries, printing and out-patients departments.

Agriculture. An investigation of a piggery was carried out to increase capacity. One man was looking after 480 fat pigs each year, but as a result of changes recommended he now has 1200 pigs in his care and an easier job to do.

A Work Study course in session at I.C. House

Instead of taking nineteen minutes and walking 1541 ft. to feed 180 pigs, he walks 113 ft. and feeds 2½ times as many pigs. On a 250-acre dairy farm a Work Study survey was made of all routine work connected with a herd of 60 cows. It was recommended that one new milking unit should be installed so that the head herdsman and his assistant could change their working routine. This was done, and now 50 cows are dealt with in an hour instead of only 38. Alterations in arrangements for feeding the cows were made and four man-hours a day saved.

British Transport Commission. Work Study has been used by British Railways in devising incentive schemes for maintenance men working on permanent way. Performances improved by 25% after incentive schemes had been in operation for only a few months. Labour relations have improved and the spirit of a sense of purpose has been fostered by close attention to details that Work Study makes necessary. Work Study has been used in layout of terminal stations and of freight and passenger services at Channel ports.

What part has I.C.I. played in all this? The answer is, quite a considerable one.

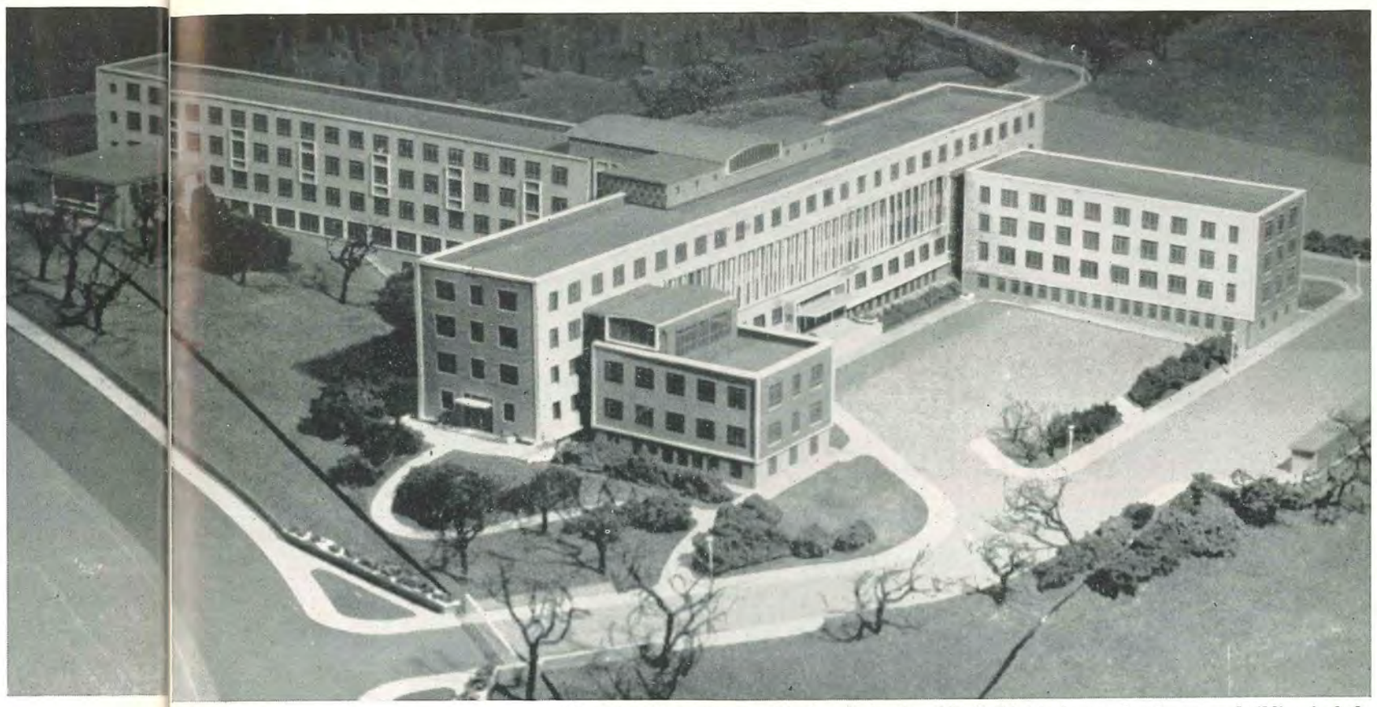
In the first place "open day" conferences run by Central Work Study Department have served to spread knowledge far and wide. These "open days" have been attended by many important people—by over 350 senior officers from the Services; by the Minister of Agriculture (Mr. Heathcoat-Amory) and prominent farming people; by over 100 senior medical, nursing and hospital administration people, including all senior officials of the Ministry of Health; by all senior members of the British Transport Commission including the chairman Sir Brian Robertson, and later by some 50 senior railway officials.

The introduction to Work Study afforded by these "open days" has been followed up by assistance in the training of Work Study officers—always a difficult bottleneck to overcome. Central Work Study Department has given special training to nearly 50 Work Study officers from the Services and to 16 agricultural Work Study specialists. It has assisted in the selection of Work Study Officers for the Westminster Hospital and for the Oxford Regional Hospital Board and has undertaken the training of these men. It has answered appeals for help from other hospitals. It has lectured, given advice and provided literature for seven Work Study training schools operated by the British Transport Commission.

In addition, the National Coal Board, the Central Electricity Authority and the Gas Boards are now all using Work Study to varying degrees, and all have received help from I.C.I. The National Coal Board has now over 300 Work Study staff, and during 1957 a monthly average of 120 studies was carried out on every aspect of mining and coal distribution.

The question will perhaps be asked: why should the Company give so much help to outside organisations? The answer is simple. Anything which will add to the prosperity of the country as a whole will in turn add to the prosperity of I.C.I.

NEWS IN PICTURES



Exercise "Lion." *More than 400 volunteers from all Divisions of I.C.I., the Regions and Head Office took part in Exercise "Lion"—the largest industrial Civil Defence exercise ever to be held in Britain—at Witton on 17th May. Also taking part were token forces from the Mobile Defence Corps and the Birmingham Division of the Civil Defence Corps. Left: One of the teams about to move a casualty to the first aid post. Below, left: Mr. T. G. Sanders (head of factory security at Witton), the Lord Mayor of Birmingham, Gen. Sir Robert Mansergh, Capt. P. Miller, Mr. R. A. Banks, Lt.-Col. F. L. Begg (Mobile Defence Corps) and Mr. J. McKay (Asst. Chief Constable of Birmingham). Below, right: Briefing before the exercise*

New headquarters. *Vital statistics for Alkali Division's new headquarters building include 2½ million bricks. The offices—we show an architect's model—have a floor area of 150,000 sq. ft. and will house all Division departments other than the Research, Technical and Engineering Departments. Estimated completion date is September 1958*

Five Swansea employees *will be taking part in the Empire Games later this month. Miss Pat Beynon is in the opening ceremony, Gordon Deeley (left), Dick James (2nd from right) and Ken Davies (right) are officials, and Mr. Ken Webb (R.N.V.R.) will be in command of one of the "Britannia" escorts when the Queen sails from Cardiff after visiting the Games*

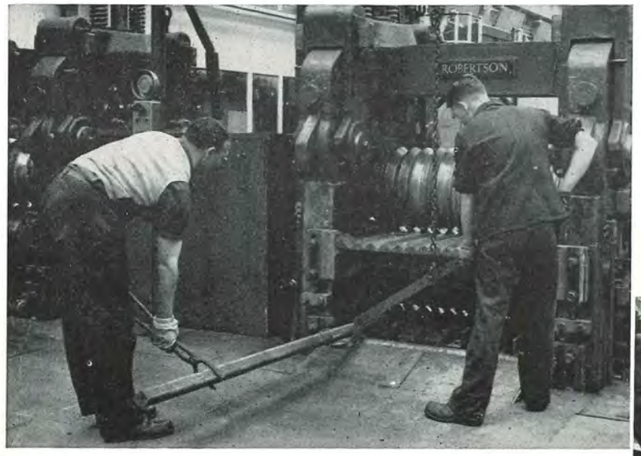
Mr. L. B. Ryder, *chairman of Lime Division, has been elected president of the Limestone Federation for the coming year*

Mr. William Broome, *who is employed in the cell room anode shop at General Chemicals' Hillhouse Works, recently completed 50 years' service*

To Gomia. *The instructors and processmen from the Ardeer Division who sailed from Liverpool for India on 31st May to* *on page 223.*)

Sabulite, St. Rollox and Dumfries factories of Nobel take up jobs at Gomia explosives factory. (*See story*

Three Billingham employees *who have completed more than 50 years' service were among guests at the Division's long service dinner: Mr. W. Fry, Mrs. Fry, Mrs. Kelly and Mr. J. W. Kelly. Standing behind them are Mr. J. Archer and Miss Susan Archer*

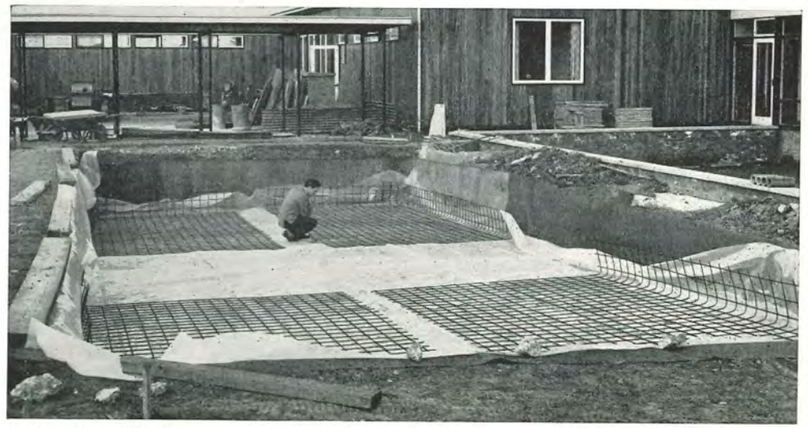


Inman Youth Cup. *This year's winner is process trainee William Kenney, seen above showing the trophy to Winnington Power Services foreman Mr. C. Mills and fellow process trainees*

Safety Trophy. *Our photograph shows Mr. R. A. Banks (Personnel Director) with the Sir George Earle Trophy which he recently received on behalf of the Company at the National Industrial Safety Conference of the Royal Society for the Prevention of Accidents*

Swansea titanium plant. *The new £3 million rolling plant whic titanium at the rate of up to 1500 tons a year of rod and 300 tons zirconium are also rolled at the plant. Above: A general view of the titanium bar to the rod rolling*

h recently came into operation can produce of sheet. Other "new" metals such as sheet finishing bay. Above, left: Feeding a mill



A 'Visqueen' lining. *A Stevenage school has a new permanent swimming pool—all for £308. It was designed by the headmaster, Mr. G. H. Anstock, and built by staff and parents. A novel feature is the complete 'Visqueen' lining beneath the concrete*

Holborn offices for Southern Region. *An artist's impression of the eight-storey office building at present under construction at a site in High Holborn which will when completed house the London staff of Southern Region and some staff in London of Metals Divisions*

Witton belles. *In a search to find the three prettiest workers in Midland industry, the "Daily Herald" visited the Witton 'Lightning' Fastener factory and chose Pauline Mountford, Pam Dawson and Glenys Moss to take part in the finals. (Photo: "Daily Herald")*

Happy ending. *A swift response by four week-end shift workers at Bain Works, Wilton, last November to an SOS from a Middlesbrough hospital for ice for their oxygen tent helped to save the life of one of the nurses dangerously ill with pneumonia. Our picture shows her with the Bain Works men, Messrs. Cousins, Dobson, Blott and Finn, when she was at Wilton recently to say thank you in person*

More chemical engineers. *Sir Alexander Fleck formally opened the new Chemical Engineering Building at the Manchester College of Science and Technology on 19th May. Above: Mr. H. Fairhurst (architect) presented two silver candlesticks to Sir Alexander as a memento of the occasion. Dr. B. V. Bowden, the College Principal, is in the centre*

Henry Cotton, *three times British golf champion, played in an exhibition match at Wilton last month. Also taking part were Mr. Hugh Laurie, the Wilton professional (left), Mr. P. C. Allen, Fibres Group Director (2nd from right), and Mr. D. Munro, winner of the Middlesbrough "Evening Gazette" Cup (right)*

Princess views I.C.I. dyes exhibits. *During a visit to Leeds University Princess Alexandra was shown the Colour Chemistry Department, where she admired the Procion-dyed and printed fabrics displayed there. Above: A member of the department is answering the Princess's questions with the aid of Dyestuffs Division's pattern cards. (Photo: "Yorkshire Post")*

The Nickel Raid

By Kenneth Shirley

Illustrated by A. Horowicz

IT was a few weeks after my eighteenth birthday, and along with the rest of my crew, the end of training had arrived and the war in the air for us was about to begin in earnest.

We had come together as a crew quite by chance at this operational training unit—I cannot recall the circumstances of our "crewing up" but I have a feeling that we all felt sorry for each other, being still "odd bods" when by that time most of the course had formed into crews preparatory to starting operations over Germany. Well, be that as it may, we had all "won" each other as it were, and, after roughly 80 hours flying together as a crew on Wellington bombers in training, were deemed adequate, if no more, to test our skill against the Luftwaffe.

Our pilot was a long, lean character of 19 years, with a gift for profane language under stress and, greatly to my personal satisfaction, a natural ability for flying twin-engined aircraft. The navigator was a former printer and had taken his appreciation of things accurate with him as an airman and was reliable, if sometimes uncommunicative.

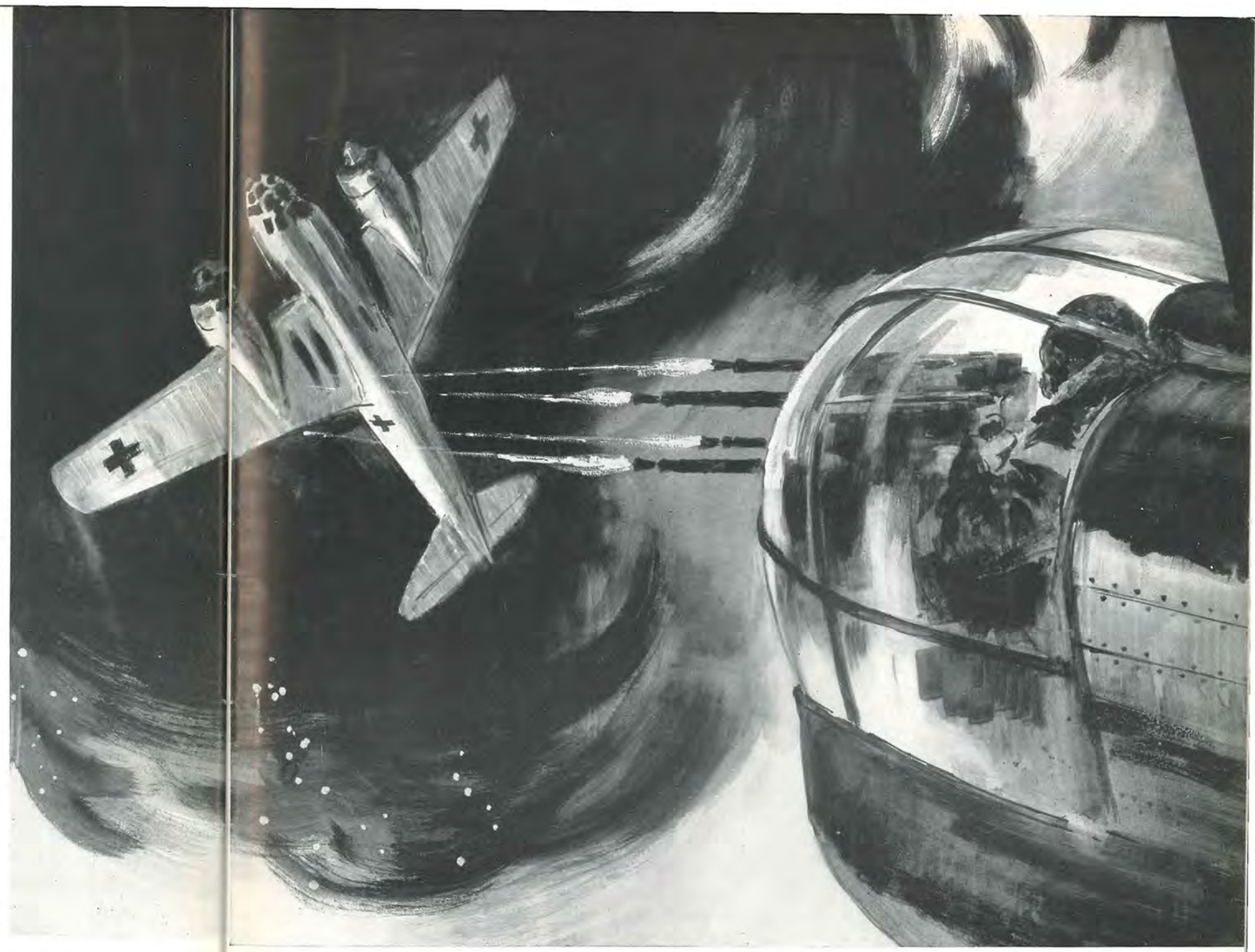
The bomb-aimer, a Canadian of some 30-odd summers, was the daddy of us all and because of his advanced years we were prone to address him as "Sir." This unaccustomed courtesy, however, was not always well received.

There remained the wireless operator, another minor in the eyes of the law and whose sole reason for becoming air-crew was, I feel sure, in order to obtain the extra pay and nourishments which went with the job. And finally myself, the rear gunner, dedicated to the defence of his aircraft, crew and himself, although not necessarily in that order.

We assembled in the main briefing room along with three other new crews, and learned the details of the operation which was to provide our debut. It was called a "Nickel" because originally when new crews embarked on operational flying over enemy territory they started with a leaflet raid, and leaflets being newspapers (in the broadest sense!) and newspapers costing at that time, in the U.S.A. or Canada, a nickel—*Q.E.D.*, these raids were called "Nickels."

There was only one minor change in the form that this "Nickel" was to take. The powers that be decided that we should be the bearers of a more persuasive memorandum in the shape of 3000 lb. high explosive. So in the end it was only a "Nickel" in so far as the target, the docks at Boulogne, was considered a relatively easy one by comparison with those in the industrial heart of Germany.

Eventually, the preliminaries of briefing behind us, the crew bus deposited each crew at its aircraft in the various dispersal points around the perimeter track of the airfield. We were the last crew to be dropped off, where the Wellington S for Sugar awaited our arrival and to me looked more formidable



. . . It had to be now, or perhaps never

than I had ever remembered seeing her before.

It was a cold, clear September night, about 22.00 hours, and a near full moon, as we made our way to our respective positions inside the bomber. The heavy flying suit which encased me, complete with "Mae West" and parachute harness, seemed to give me more trouble than usual when squeezing into the cramped rear gun turret. I connected the oxygen supply and fastened the mask across my nose and mouth, cocked each of the four Browning ·303 in. machine guns ready for firing, switched on the reflector sight and slowly rotated the turret through its 180° arc.

The aircraft did not seem to be shaking so much as it usually did while we were taxi-ing to the end of the runway—no doubt due to the weight of the bomb-load. A green from the Aldis lamp at the chequered caravan and then we were speeding down the runway, hangar warning lights flashing past until our smooth movement told me that we were airborne.

"Course 190°, Skipper," the navigator's quiet voice came over the inter-comm quite briskly. As we turned on to course I saw we had already climbed to about 2000 ft. and in the bright moonlight the ground assumed an eerie appearance of another world, while the star-splashed sky still seemed strangely remote.

I swung the turret slowly to and fro from port to starboard and wondered whether even now the German night-fighter defences were aware of our intentions and were preparing to intercept us.

The pilot's voice cut suddenly over the inter-comm into my introspection. "Hallo rear gunner—you still awake?" It was good to know that I was remembered as it tended to be a rather lonely vigil for the gunner in the tail, out of sight and company with the rest of his crew. I gave a grateful affirmative and the inter-comm lapsed once more into silence.

I resumed my search into the darkness, aware now that we were approaching the coast and remembering to scan the dark side of the sky several times to each of the light side. You didn't know that there was a light and dark side to the sky? Neither did I until those days, but it is a definite fact.

At 22,000 ft. the English Channel had the appearance of a mere river, and we were running in over the French coast in an astonishingly short time.

I took my eyes momentarily from the skies and glanced earthwards. Puzzled by some sporadic flashes on the ground I switched on the inter-comm to comment upon this phenomenon, when a series of tearing explosions erupted with frightening noise close to the port wing.

This put an immediate end to my speculation on the flashes I had seen on the ground—this must be the flak that up to then I had only heard about.

I added to the babble of sound already on the inter-comm, yelling to the pilot to dive port. I need not have bothered though, as we were already in the first violent turn of this evasive action while further flak shells exploded into black smoke puffs with orange centres, slightly above and astern. I could hear the shrapnel ripping through the fabric covering of our aircraft and caught the sickening stench of cordite fumes.

The only sound over the inter-comm now was somebody's harsh breathing and the pilot's voice shouted "For —— sake turn that microphone off, somebody!" Then the bomb-aimer's Canadian burr, "Bomb-bay doors open, Skipper," and a series of left-lefts, right-rights and steadies.

I was conscious that I was sweating profusely even without heating and the air temperature down to 25° below zero, while all around me the night was torn with exploding shells and the furious glow of fires from the target area below.

A violent upward jerk of the aircraft followed immediately on the welcome words "Bombs gone"—and what seemed ages afterwards, the shuddering turn out of the murderous barrage of flak, towards the French coast.

The navigator's laconic tone gave the new course to the pilot and we steadied down for the homeward journey. The bomb-aimer's voice broke in: "Did you see the bombs burst, rear gunner?" Hell! I had never even thought to look while all that was going on. I flicked on my inter-comm—"No, there seemed to be smoke and fires everywhere." Well, that was true, anyway. "It doesn't matter a God damn," he grunted. "The camera was going O.K." I was relieved to hear this, and the inter-comm once more lapsed into silence.

The Channel slid slowly beneath us and the tension built up over the previous hours began to subside and a somewhat lightheaded atmosphere took its place.

"That was a pretty good effort, Murph," the pilot's voice broke cheerfully through to the bomb-aimer. "Yeah," he said. "They'll sure know we've been around all right."

I was still swinging the turret at this time but now in a more relaxed composure, the battle being more or less done and thoughts of our impending leave running pleasantly through my head.

Then I caught a momentary glimpse of a black shape moving slightly above the port quarter, possibly a couple of hundred yards away, and my mouth went suddenly dry. For the moment I dared not trust myself to speak—then I hurriedly controlled my panic and switched on the inter-comm. "Rear gunner to pilot—aircraft port quarter, up—stand by to corkscrew port."

The tossing back and forth of casual chatter over the inter-comm stopped abruptly. I felt a cold knot of fear tightening in my stomach as I watched the movement of the ominous black shape, now sliding dead astern and closing rapidly.

I waited no longer. "Corkscrew port—GO!" I opened fire with a long burst from the four Browning machine guns, forcing myself to stifle the mounting fear inside me as the enemy's return fire seemed to stream towards my face. Slowly the Wellington

We started to laugh . . . as if we had just heard the funniest story imaginable

mushed at the bottom of the first turn of the corkscrewing evasive action before climbing into the next turn. The centrifugal pressure riveted me to the seat, and the enemy aircraft, now clearly a JU88 night fighter, was firing furious bursts of cannon shells and all I could hear was the laboured groaning of the Wellington's two Hercules 1600 h.p. engines as we frantically slewed round in an effort to avoid the shells which were tearing into the fuselage.

I could no longer think clearly as to how to escape from this frightening attack until the JU88 broke off and banked away to starboard, exposing its big underside, like some huge bird of prey.

Realisation swept over me at this point—it had to be now, or perhaps never. All thoughts of overheating the guns were gone, angles of deflection forgotten. At that moment I could see only one thing in my frightened anger—that big exposed belly. The turret filled with the acrid fumes of cordite from the long, continuous bursts of fire from the Brownings and I was still firing some little while after somebody shouted wildly over the inter-comm "You've hit it! You've hit it!"—then tailing off as the pilot yelled for silence.

The enemy plane was falling to starboard now—flames leaping from its port engine and sweeping over the wing, thick black smoke silhouetted against the moonlit cloud below. Then with dramatic suddenness it was gone, leaving an empty, peaceful sky.

The inter-comm broke once again into a free-for-all confused babble of sound —"Bloody good. Oh, bloody good!—Did you see? What the hell!—How the hell? Nearly had kittens!"—until the pilot broke it up with his customary blasphemous request for order and instructions to the wireless operator to check the damage aft.

Miraculously the damage mainly consisted of shell-torn fabric throughout the fuselage, it appeared. So we flew on until the base beacon was sighted and the routine of preparing to get down was started.

One thousand feet on the circuit, turning into the funnel lining us up with the runway at 800 ft.—angle of approach beautifully in line with the Glide Path Indicator—flare path rushing to meet us and the runway speeding a few feet beneath us. We touched down. Simultaneously a muffled explosion shook the tired Wellington and we were off the runway—twisting, sliding, slithering across the airfield in a series of nightmare swinging circles, finally subsiding into a shuddering, silent stop. We had burst a tyre!

Later, standing shakily together near the aircraft, we started to laugh—quietly at first, then louder and louder and finally just roaring at the whole thing, as if we had just heard the funniest story imaginable.

It was the bomb-aimer, you see, because he had said "Waal, if that was only a God-damn 'nickel' you can deal me out when we move into the big dough!"

"Pigeons' Tea-time"

Photo by P. F. Bowles (Brixham)